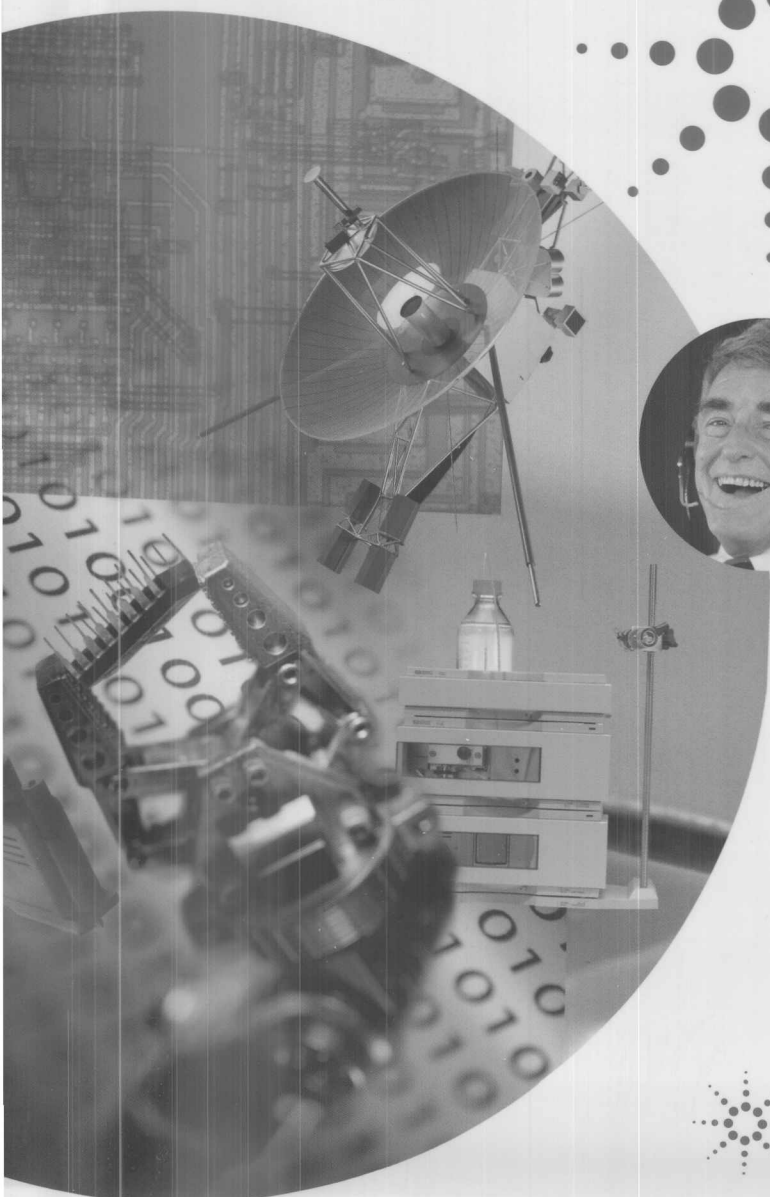
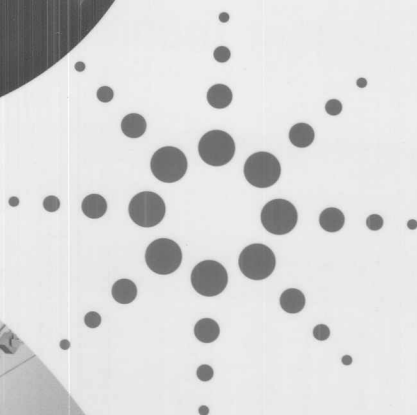


# Optocoupler Preference Guide



**Agilent Technologies**  
Innovating the HP Way

Introducing Agilent Technologies, the result of Hewlett-Packard's strategic realignment of its businesses. Combining the core strengths of test and measurement instruments, semiconductor and optical communications components, Agilent Technologies is a global leader of innovative, high quality products and services.

## Agilent Technologies Optocoupler

Function		Digital Isolation								Analog Isolation		
		Power Device Drive		Data Interface			A-D Isolation		P/S Monitor	Cur. Sens	Vol. Sens	Others
Market	Application	Inverter	Others	Field Bus	RS422/485	Others	ADC/DAC	V-F Conv				
Industrial	Motor Inverter	8		7	5	3 4 10		5 1		9	9 13	
	Servo Driver	8		7	5	3 4 10				9	9 13	
	NC/Robot	8			5	3 4 10			12	9	9 13	
	Sewing	8								9		
	Elevator	8							12	9		
	PLC	8		7	5	3 4 11	5	5 1	12			9 13
	Welding/IH		8							9		
	Solar Gen.	8									9 13	
	Board CPU	8		7	5	3 4 10	5	5 1				
	ThermoCnt/Recorder			7	5		5	5 1				13
	Process meter			7	5	11	5	5 1	12		13	9 13
	Instrument					3 4 10	5					13
	FFT/Data logger						5 6					
	On-board P/S											13
Medical	CT/MMR					5 6	5 6					
	Heart Signal/Supersonic					5 6	5 6					

Agilent Technologies is the only supplier in the world to offer the fastest optocouplers with multiple packaging to ensure that your designs will be the best. Our optocouplers also meet worldwide regulatory standards and are widely accepted in the Industrial, Communication and Consumer markets.

Agilent Technologies promises to continue to develop and offer innovative products to meet your extensive design needs.

## – Function vs Application Matrix

Function		Digital Isolation								Analog Isolation		
		Power Device Drive		Data Interface			A-D Isolation		P/S Monitor	Cur. Sens	Vol. Sens	Others
Market	Application	Inverter	Others	Field Bus	RS422/485	Others	ADC/DAC	V-F Conv				
Traffic	EV	8		7		5				9		
	Transportation system	8		7		5						
CPU, OA	UPS	8								9	9 13	
	Monitor											1
	Network				5	13 6						
	HDD					6 2						
	Printer/Copier					13 5						
	ECR, POS				5	13 5						
	PC Projector		8									
Consumer	Arcade Game				5	5						
	Aircon	8								9		
	Refrigerator/Washer	8										
	TV											13
	Musical (MIDI)					5						
	PDP, EL		8			5 7						
Telecom	PBX					6 7			12			
	ISDN, Kraoke					2			12			

# 1 MBd Transistor Output Optocoupler

## Packages



300 mil DIP

### SMD Package



SO 8

### "Widebody" Package



400 mil DIP



SO-5



SO 16

Device	Part No.	Package				If	Prop Delay		CTR		CMR-V/ $\mu$ s @ (Vcm)			VDE 0884			Insulation		Note
		300 mil DIP	SO8	400 mil DIP	SO 5		tPHL	tPLH	Min %	Max %	1000 (10 V)	10000 (1.5 kV)	15000 (1.5 kV)	Peak Voltage			UL = 1 min.		
							$\mu$ s (max)							630 V	890 V	1414 V	2500 V	5000 V	
Single	6N135	•				16	2.0	2.0	7	50	•						•	B	
	HCPL-0500		•			16	2.0	2.0	7	50	•						•		
	HCNW135			•		16	2.0	2.0	7	150	•				•		•		
	6N136	•				16	1.0	1.0	19	50	•						•	B	
	HCPL-0501		•			16	1.0	1.0	19	50	•						•		
	HCNW136			•		16	1.0	1.0	19	150	•				•		•		
	HCPL-4502	•				16	1.0	1.0	19	50	•						•	B	1
	HCPL-M452				•	16	1.0	1.0	19	50		•							3
	HCPL-0452		•			16	1.0	1.0	19	50	•						•		1
	HCNW4502			•		16	1.0	1.0	19	150	•					•		•	1
	HCPL-4503	•				16	1.0	1.0	19	50			•	•			•	B	1,2
	HCPL-0453		•			16	1.0	1.0	19	50			•				•		1
	HCNW4503			•		16	1.0	1.0	19	150			•			•		•	1
	HCPL-M453				•	16	1.0	1.0	19	50			•				•		3
	HCPL-M454				•	12	1.0	1.4	26	65		•							3
	HCPL-M456				•	10	0.4	0.55	44	>90			•						
	HCPL-4504	•				12	1.0	1.14	26	65		•		•			•	B	1,2
	HCPL-0454		•			12	1.0	1.14	26	65		•					•		1
	HCPL-J454	•				12	0.5	0.7	21	65			•		•		•		
	HCNW4504			•		12	0.5	0.7	25	65		•				•		•	1
	HCPL-4506	•				10	0.4	0.55	44	>90			•	•			•	B	3
	HCPL-0466		•			10	0.4	0.55	44	>90			•				•		
	HCPL-J456	•				10	0.4	0.55	44	>90			•		•		• A		
	HCNW-4506			•		10	0.4	0.5	44	>90			•				•	•	
Dual	HCPL-2530	•				16	2.0	2.0	7	50	•						•	B	
	HCPL-0530		•			16	2.0	2.0	7	50	•						•		
	HCPL-2531	•				16	1.0	1.0	19	50	•						•	B	
	HCPL-0531		•			16	1.0	1.0	19	50	•						•		
	HCPL-4534	•				16	1.0	1.0	19	50			•				•	B	
	HCPL-0534		•			16	1.0	1.0	19	50			•				•		

Red bold text – RECOMMENDED FOR NEW DESIGNS

NOTES: 1. PIN 7 not connected. 2. 630 V peak VDE 0884 with option 060. 3. No built-in pull resistor. A. 3750 Vrms / 1 min. B. Option 020



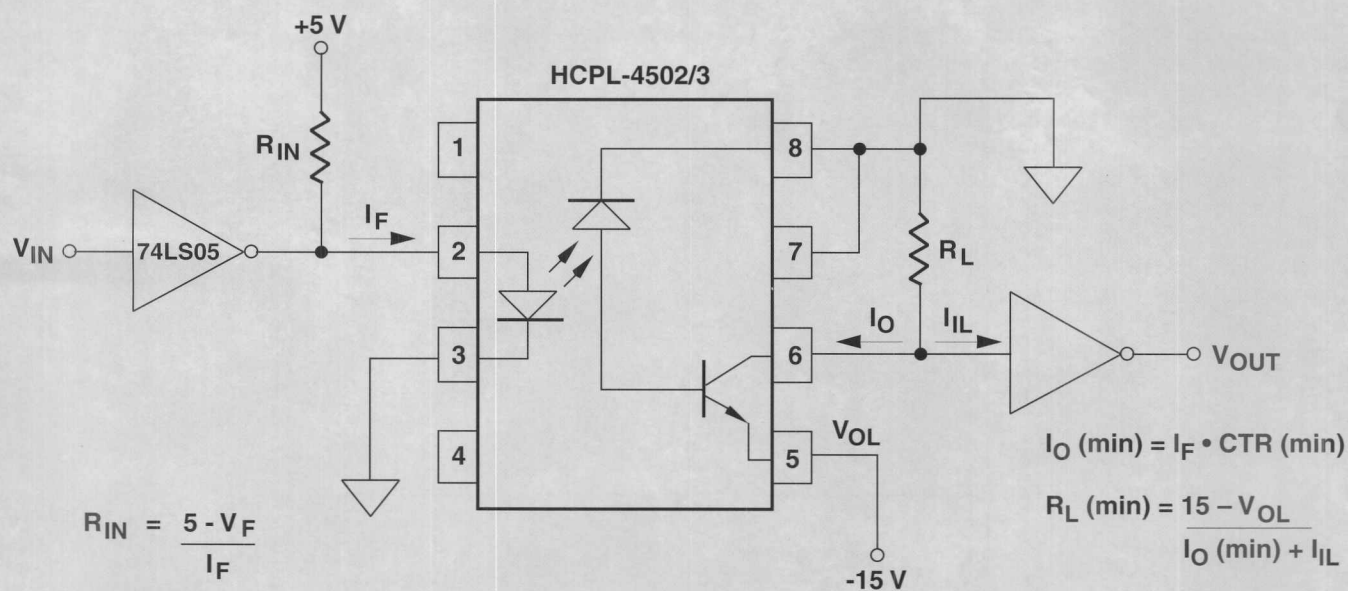
The circuit shows how a 0 to 5 V logic signal can be level shifted to a -15 to 0 V signal. This circuit can safely be used for level shifting up to  $\pm 800$  V. The circuit uses an open collector output logic gate, the 74LS405, to drive the LED of the HCPL-4502/3 optocoupler. The HCPL-4502/3 also has an open-collector output. The designer chooses  $R_{IN}$  to agree with the equation shown in the schematic. This equation sets the value of the optocoupler LED forward current. The output of the HCPL-4502/3 requires a pull-up resistor,  $R_L$ . The current-transfer ratio (CTR) of the optocoupler determines the maximum amount of current the optocoupler output can sink while maintaining the output voltage (between pins 5 and 6) of 0.5 V or less.

The benefits of the application is that it reduces transient immunity problem and is a convenient way of replacing pulse transformer for high-voltage level shifting.

Other Possible Applications include:

- High Speed Logic Ground Isolation
- Replace slow Phototransistor Isolators
- Replace Pulse Transformers
- Line Receivers
- Analog Signal Ground Isolation

#### Typical Level Shifting/TTL Interface Block Diagram



NOTE: FOR BEST CMR PERFORMANCE, CONNECT PIN 7 TO PIN 8.

# 100 KBd Darlington Transistor Output Optocoupler

## Packages



300 mil DIP

SMD Package



S0 8

"Widebody" Package



400 mil DIP

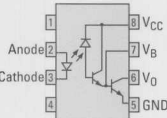
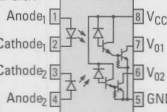


S0-5

SMD Package



S0 16

Device	Part No.	Package				If			CTR	VDE 0884		Insulation		Note
		300 mil DIP	S08	400 mil DIP	S05	40μA	0.5 mA	1.6 mA	Min. %	Peak Voltage		UL = 1 min.		
										630 V	1414 V	2500 V	5000 V	
<div>Single</div> <div></div>	6N138	•						•	300			•		
	HCPL-0700		•					•	300			•		
	HCNW138			•				•	300		•		•	
	HCPL-M700				•			•	300					
	6N139	•					•		400			•	B	
	HCPL-0701		•				•		400			•		
	HCNW139			•			•		400		•		•	
	HCPL-M701				•		•		400					
	HCPL-4701	•				•			800	•		•	B	2
	HCPL-070A		•				•		800			•		1
	HCPL-2730	•						•	300			•	B	
<div>Dual</div> <div></div>	HCPL-0730		•					•	300			•		
	HCPL-2731	•					•		400			•		1
	HCPL-0731		•			•			400			•		1
	HCPL-4731	•			•				800			•		1
	HCPL-073A		•		•				800			•		1

Red bold text – RECOMMENDED FOR NEW DESIGNS

NOTES: 1. PIN 7 not connected. 2. 630 V peak VDE 0884 with option 060. B. Option 020

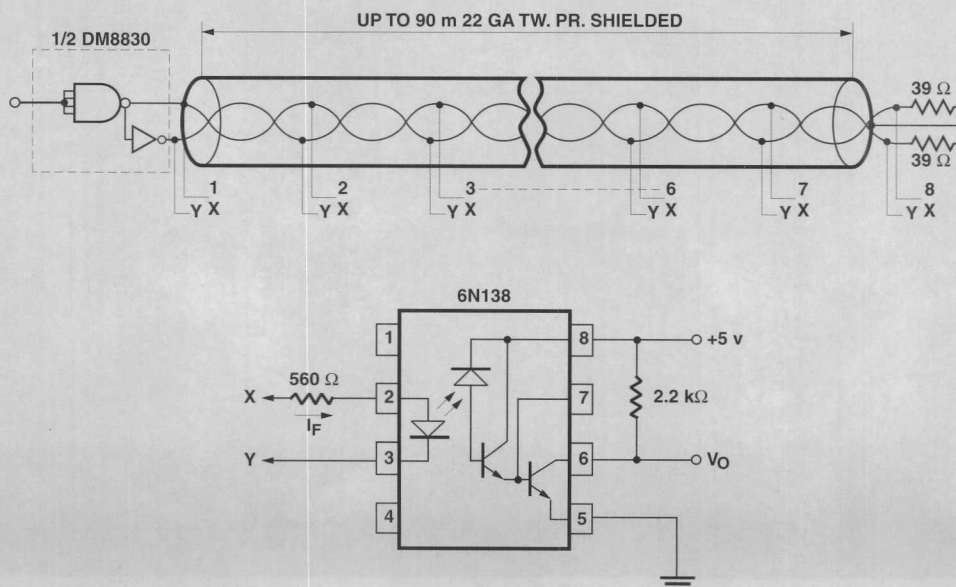
This differentially driven circuit can use up to eight 6N138 optocouplers at various receiver along the 90 m line. All stations are isolated. The first station would draw approximately 2.7 mA current, and the last station 1.8 mA of LED drive current. The output grounds of the optocoupler may be electrically separate.

The benefits of the application is its simple, low-cost, multidrop circuit for low signaling rates.

Other Possible Typical Applications include:

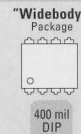
- Digital Logic Ground Isolation
- Telephone Ring Detector
- FIA RS-232C Line Receiver
- Low Power Systems and Ground Isolation

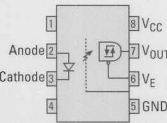
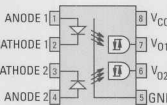
## Typical Multi-drop Line Receiver Block Diagram



# 5 MBd Logic Gate Optocoupler

## Packages



Device	Part No.	Package			If	CMR-V/μs @ (Vcm)			VDE 0884		Insulation		Note
		300 mil DIP	SO8	400 mil DIP		mA	1000 (50 V)	2500 (1400 V)	10000 (1 kV)	Peak Voltage 630 V   1414 V		UL = 1 min. 2500 V   5000 V	
<div>Single</div> <div></div>	HCPL-2200	•			1.6	•							2
	HCPL-2219	•			1.6		•		•		•		2
	HCPL-2201	•			1.6	•							2, 4
	HCPL-2202	•			1.6	•							2, 4, 5
	HCPL-0201		•		1.6	•							4
	HCNW2201			•	1.6	•				•		•	4
	HCPL-2211	•			1.6			•	•				2, 4
	HCPL-2212	•			1.6			•	•		•		2, 4, 5
	HCPL-0211		•		1.6			•					4
	HCNW2211			•	1.6			•		•		•	4
<div>Dual</div> <div></div>	HCPL-2231	•			1.8	•					•		
	HCPL-2232	•			1.8			•			•		6

Red bold text – RECOMMENDED FOR NEW DESIGNS

NOTES: 2. 630 V peak VDE 0884 with option 060. 4. PIN 6 not connected. 5. PINS 6 and 7 reversed. 6. CMR=5000

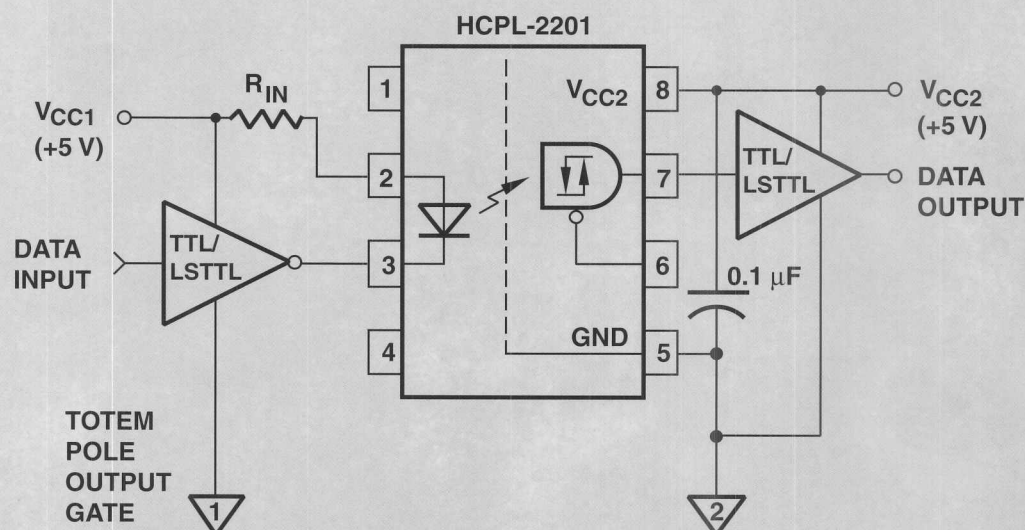
The circuit shown is an interface between two TTL gates using an active output (totem pole) optocoupler, the HCPL-2201. A series switching circuit drives the optocoupler LED. The active output HCPL-2201 can be directly connected to a TTL gate, and no pull-up resistor is required. The HCPL-2201 can sink enough current to handle up to 16 LSTTL or 4 TTL loads.

The benefits include no pull-up resistor required on the optocoupler output interface. Low power dissipation on the optocoupler input circuit and up to 20 V supply voltage for the HCPL-2201.

Other Possible Applications include:

- Computer-Peripheral Interface
- Microprocessor System Interface
- High Speed Line Receiver
- Pulse Transformer Replacement
- Ground Loop

## Typical TTL Interface Block Diagram



$$R_{IN} = \frac{V_{CC1} - V_F - V_{OL}}{I_F}$$

RECOMMENDED  $R_{IN} = 1.1 \text{ k}\Omega$



# 8 MBd Logic Gate Optocoupler

## Packages



300 mil DIP

### SMD Package



S08

### "Widebody" Package



400 mil DIP



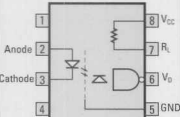
S0-5

### SMD Package

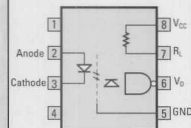


S016

Device	Part No.	Package				If	CMR-V/ $\mu$ s @ (Vcm)				VDE 0884		Insulation		Note
		300 mil DIP	S08	400 mil DIP	S05	mA	100 (50 V)	1000 (50 V)	2500 (1400 V)	10000 (1 kV)	Peak Voltage 630 V   1414 V		UL = 1 min. 2500 V   5000 V		
Single	HCPL-2300	•				0.5	•				•		•		2



The diagram shows the internal circuit of the HCPL-2300 optocoupler. It includes an LED (Anode at pin 2, Cathode at pin 3) connected to a resistor and Vcc (pin 8). The LED is optically coupled to a phototransistor (Emitter at pin 4, Collector at pin 6). The phototransistor is connected to a resistor and Vcc (pin 8). The output (pin 6) is connected to V0. The input (pin 2) is connected to Vcc (pin 8). The ground (pin 5) is connected to GND.



NOTES: 2. 630 V peak VDE 0884 with option 060.

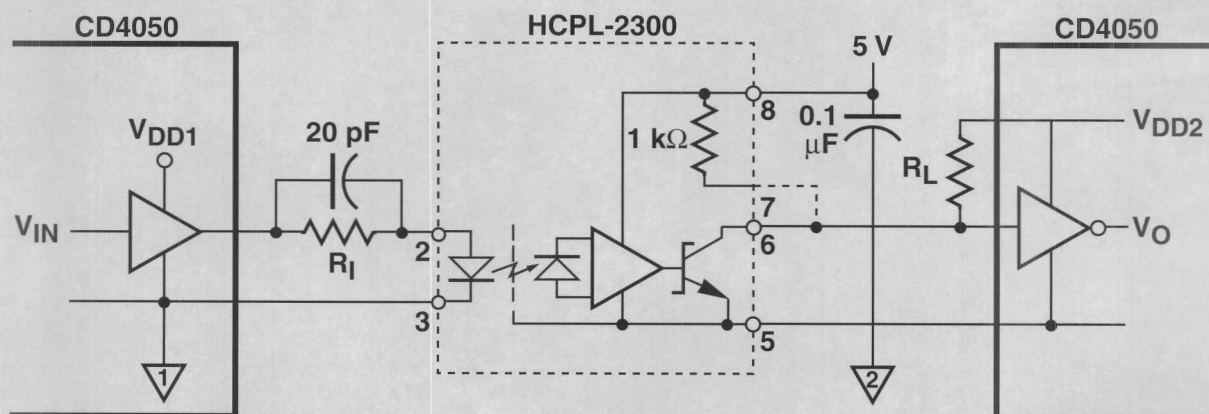
The circuit shows a CMOS interface circuit for 8 MBd applications. Over the temperature range a CMOS CD4050 Hex Buffer can source about 0.7 mA (minimum), which is sufficient to drive the HCPL-2300 optocoupler. The 20 pF capacitor allows peaking currents to assist the LED turn on and off quickly.

The benefits of the applications are that it is a simple interface and it consumes only low power.

Other Possible Typical Applications include:

- High Speed, Long Distance Isolated Line Receiver
- RS 232C Interface
- Digital Isolation for A/D, D/A Conversion
- Computer-Peripheral Interface
- Level Shifting

## Typical CMOS Interface Block Diagram



$V_{DD1}$ (V)	$R_1$ (k $\Omega$ )	$R_L$ (k $\Omega$ )	$V_{DD2}$ (V)
5	5.11	1	5
10	13.3	2.37	10
15	19.6	3.16	15

# 10 MBd Logic Gate Optocoupler

## Packages



300 mil DIP

### SMD Package



S08

### "Widebody" Package



400 mil DIP



S0-5

### SMD Package



S016

Device	Part No.	Package				If mA	Prop Delay tPHL/tPLH ns (max)	CMR-V/ $\mu$ s @ (Vcm)					VDE 0884		Insulation UL = 1 min.	Note
		300 mil DIP	S08	400 mil DIP	S05			1000 (50 V)	5000 (50 V)	10000 (200 V)	10000 (1 kV)	15000 (1 kV)	Peak Voltage 630 V 1414 V			
Single 	6N137	•				5	100								•	B
	HCPL-0600		•			5	100								•	
	HCNW137			•		5	100						•		•	
	HCPL-M600				•	5	100									
	HCPL-2601	•				5	100		•						•	B
	HCPL-0601		•			5	100		•						•	
	HCNW2601			•		5	100		•				•		•	
	HCPL-M601				•	5	100		•							
	HCPL-2611	•				5	100				•		•		•	B 2
	HCPL-0611		•			5	100				•				•	
	HCPL-M611				•	5	100				•				•	
	HCNW2611			•		5	100				•		•		•	
	HCPL-261A	•				2	100	•	•				•		•	B 2
	HCPL-061A		•			2	100	•	•						•	
	HCPL-261N	•				2	100				•	•	•		•	B 2
	HCPL-061N		•			2	100				•	•			•	
Dual 	HCPL-2630	•				5	100								•	B
	HCPL-0630		•			5	100								•	
	HCPL-2631	•				5	100								•	B
	HCPL-0631		•			5	100								•	
	HCPL-4661	•				5	100								•	B
	HCPL-0661		•			5	100								•	
	HCPL-263A	•				5	100	•	•						•	B
	HCPL-063A		•			5	100	•	•						•	
	HCPL-263N	•				2	100				•	•			•	B
	HCPL-063N					2	100				•	•			•	

Red bold text – RECOMMENDED FOR NEW DESIGNS NOTES: 2. 630 V peak VDE 0884 with option 060. B. Option 020

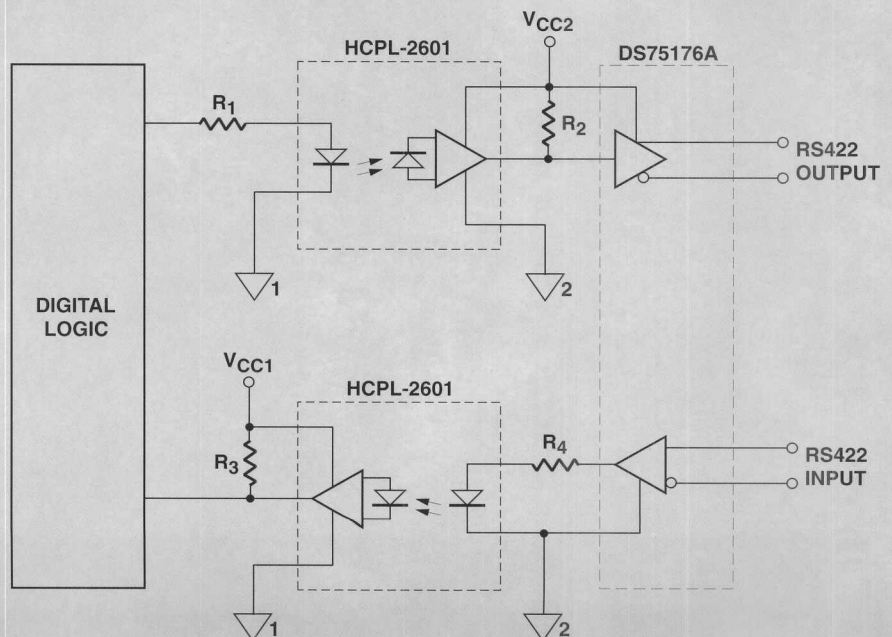
This isolated RS-422 circuit uses two high-speed optocouplers that can switch up to 10 MBd signals. An isolated power supply Vcc2 is required to power the DS 75176A driver/receiver integrated circuit.

The main benefit is that it prevents common-mode transients from interfering with the signal.

Other Possible Applications include:

- Switching Power Supply
- Instrument Input/Output Isolation
- Isolated Line Receiver
- Computer-Peripheral Interface
- Microprocessor System Interface

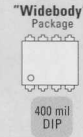
## Typical RS-422 Interface Block Diagram

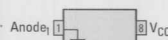




# 20 MBd Logic Gate Optocoupler

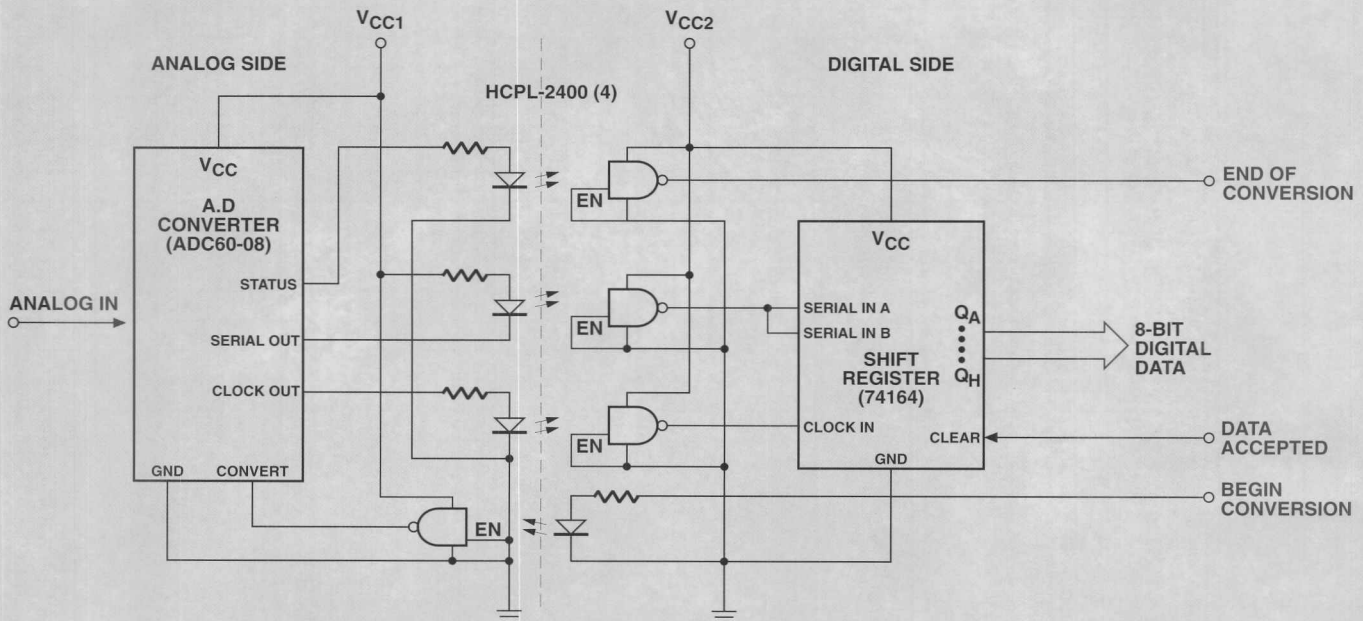
## Packages



Device	Part No.	Package				If	Prop Delay	CMR-V/ $\mu$ s @ (Vcm)						VDE 0884		Insulation	Note	
		300 mil DIP	S08	400 mil DIP	S05	mA	tPHL/tPLH ns (max)	1000 (50 V)	2000 (200 V)	5000 (50 V)	10000 (200 V)	10000 (1 kV)	15000 (1 kV)	Peak Voltage 630 V   1414 V		UL = 1 min. 2500 V   5000 V		
	HCPL-2400	•				4	60	•						•		•		2
	HCPL-2430	•				•	60	•								•		

NOTES: 2. 630 V peak VDE 0884 with option 060.

## Typical Block Diagram



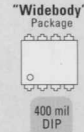
These optocouplers have high data rate capability and low input current requirements. In analog-to-digital converters, designers should isolate the two portions of a circuit so that interference generated by digital switching and clock signals is not coupled to the analog section. The above figure demonstrates the ability of optocouplers to achieve isolation in a high speed parallel interface data communication application. Optocouplers reduce the channel distortion and thereby maximize the reliability of the circuit.

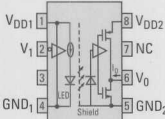
### Other Possible Applications include:

- Isolation of Higher Speed Logic System
- Computer-Peripheral Interface
- Isolated Bus Driver (Networking Applications)
- Switching Noise Elimination
- High Speed Disk Drive I/O

# High Speed CMOS Logic Gate

## Packages



Device	Part No.	Package		Data Rate	PWD		Prop Delay
		300 mil DIP	S08		8 ns (max)	6 ns (max)	
	HCPL-7710	•		12.5	•		40
	HCPL-7720	•		25	•		40
	HCPL-7721	•		25		•	40
	HCPL-0710		•	12.5	•		40
	HCPL-0720		•	25	•		40
	HCPL-0721		•	25		•	40
	<ul style="list-style-type: none"> <li>10 kV/μs CMR @ <math>V_{cm} = 1000</math> V</li> <li><math>V_{orm} = 630</math> V VDE, 3750 Vac UL Approval</li> </ul>						

Red bold text – RECOMMENDED FOR NEW DESIGNS

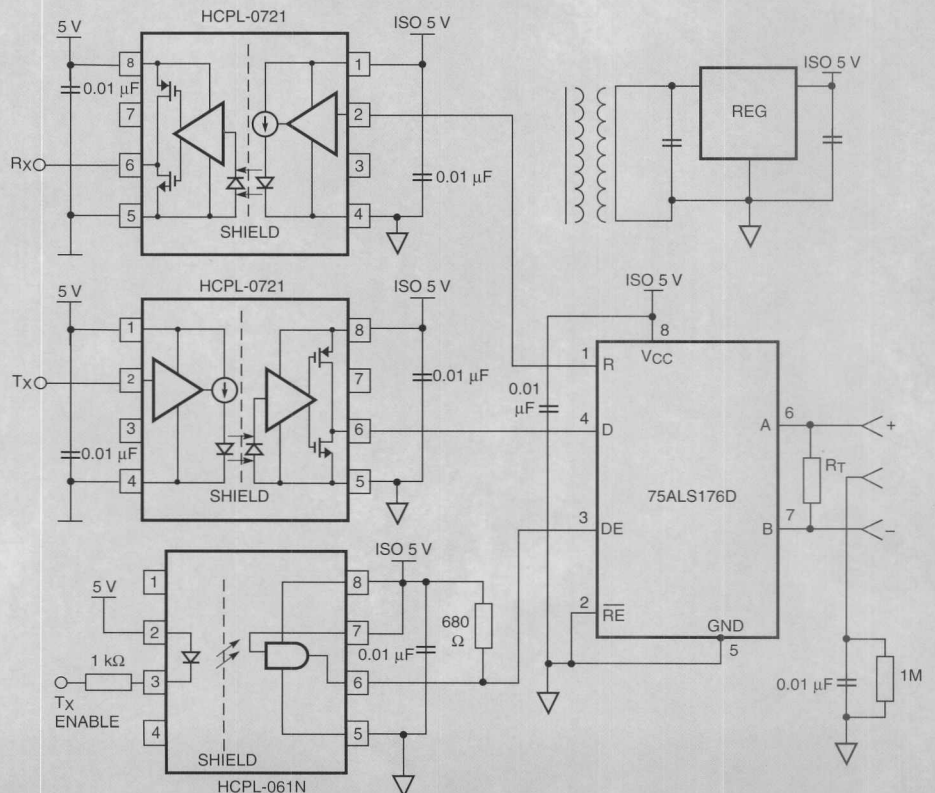
These optocouplers use the latest CMOS IC technology to achieve outstanding performance with very low power consumption. Serial fieldbuses are used today primarily as the communication system for exchange of information between automation system and distributed field devices. PROFIBUS is the leading open fieldbus system and has worldwide acceptance. PROFIBUS is essentially a twisted wire pair serial link that is very similar to RS 485. Profibus speed standard is either lower speed (1.5 MBd) or higher speed (12 MBd).

In this isolated multipoint transmission application circuit, two different optoisolators are utilized (HCPL-0721 and HCPL-061N). The benefits include low input drive current that maximizes LED lifetime/reliability and optimized speed for Profibus and RS-485 applications.

Other Possible Applications include:

- CAN Bus
- CC\_Link
- Microprocessor System Interface
- Multiplexed Data Transmission
- AC Plasma Display Panel Level Shifting
- Switched Mode Power Supply

## Typical Profibus Block Diagram



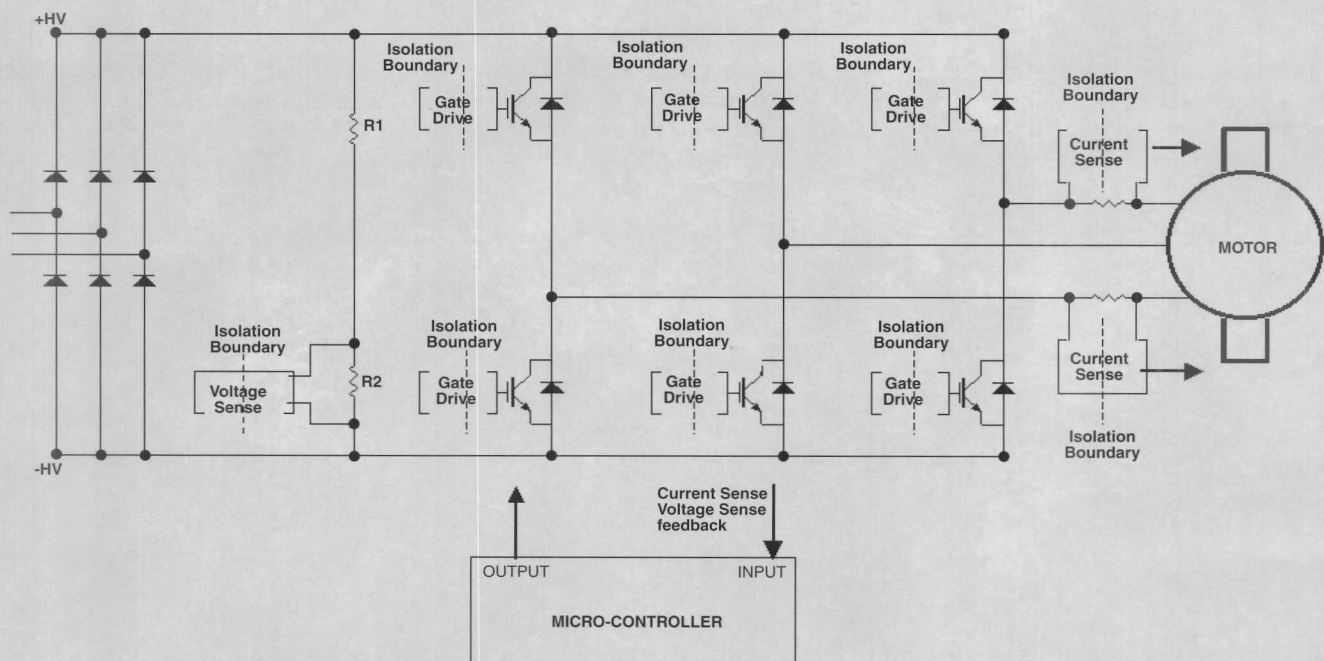
# Motor Drive Application

In typical motor drive and power control systems, there are several signals between the power devices and the micro-controller that need isolation and additional customized functions such as gate drive and current/voltage sensing. Agilent gate drive and isolation amplifier products provide low cost, high performance solutions for motor control applications.

High performance motor drives require precision timing for turning on and off the power devices on the inverter. The micro-controller that controls these functions needs to be isolated from high voltage inverter side. Agilent offers a variety of optoisolators that have built in gate drive capability. For those solutions that require lower output power capability, IPM interface optocouplers will meet the need.

Here is a typical circuit diagram of a motor drive system, also commonly called the inverter.

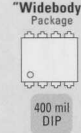
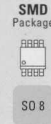
**Typical Motor Drive Block Diagram**





# Integrated Gate Drive Optocoupler

## Packages



Device	Part No.	Package			I <sub>f</sub> (on)	I <sub>out</sub>	Prop Delay					PWD		V <sub>cc</sub>	VDE 0884			CMR-V/μs @ (V <sub>cm</sub> )			Note
		300 mil DIP	400 mil DIP	SO16	mA	A min	t <sub>PHL</sub>	μs (max)	0.5	0.7	2	5	0.3 μs max	0.8 μs max	V max	Peak Voltage 630 V 890 V 1414 V			8000 (1500)	10000 (1500)	

<div><div>VIN+</div><div>VIN-</div><div>VCC1</div><div>GND1</div><div>RESET</div><div>FAULT</div><div>VLED1+</div><div>VLED1-</div></div> <div><div>V<sub>E</sub></div><div>V<sub>LED2+</sub></div><div>V<sub>DESAT</sub></div><div>V<sub>CC2</sub></div><div>COLL</div><div>V<sub>OUT</sub></div><div>V<sub>CE</sub></div><div>V<sub>EE</sub></div></div>	HCPL-314J			•	10	0.4		•				•		24		•			•		
	Dual 0.4 A Gate Drive Optocoupler with two separated channels																				
	HCPL-315J			•	16	0.5		•				•		30		•				•	
	Dual 0.5 A Gate Drive Optocoupler with two separated channels																				
	HCPL-316J			•	1μA	2		•				•		30		•				•	
2.0 A Gate Drive Optocoupler with integrated over-current Protection and Fault Feedback																					
<div><div>• CMOS compatible</div><div>• Under Voltage Lock-Out Protection (UVLO) with Hysteresis</div><div>• Regulatory Approvals: UL, CSA, VDE = 890 Vpeak</div></div>																					

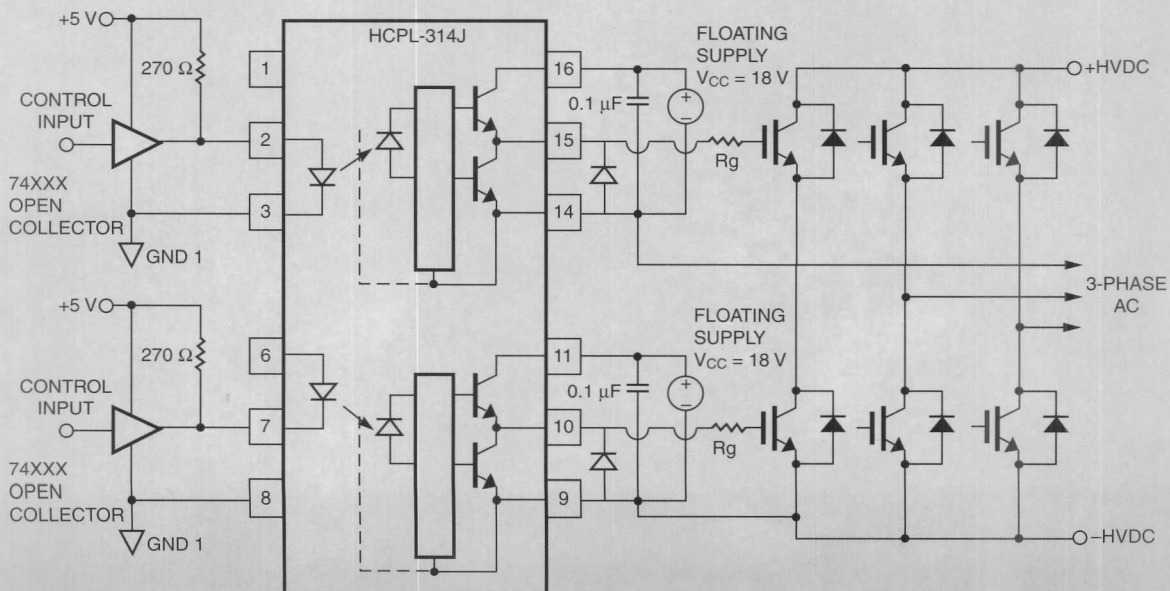
Red bold text – RECOMMENDED FOR NEW DESIGNS

NOTES: 2. 630 V peak VDE 0884 with option 060.

This circuit depicts 2 IGBTs or MOSFETs being directly driven by HCPL-314J and providing full regulatory approved isolation between the power and control circuits. The output power supply can be derived from rail supply by using a bootstrap circuit. The value of  $R_g$  is chosen to control the peak gate charge and discharge current as well as the output power dissipation.

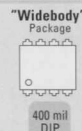
HCPL-314J has superior common-mode transient noise immunity and the dual-in-1 package saves assembly cost. An external clamp diode may be connected between Pins 9 & 10 and Pins 14 & 15 for the protection of HCPL-314J in the case of IGBT, switching inductive load.

## Typical Gate Driver for IGBT/MOSFET Application



# Miniature Isolation Amplifiers

## Packages



Device	Part No.	Package		Gain Toler.		Non-Linearity		Prop Delay			VDE 0884			CMR-V/ $\mu$ s @ (Vcm)	Note
		300 mil DIP	S016	3%	5%	% (max)		$\mu$ s max			Peak Voltage			10000 (1000)	

	HCPL-7800	•		•		•		•		•		•	8	
	HCPL-7840	•				•		•		•		•	7	
	HCPL-7860	•		Isolated 12 bit A/D Converter with Isolated Modulator										
	HCPL-786J		•	Isolated 12 bit A/D Converter with Isolated Modulator with better creepage and clearance										
	HCPL-7870	Interface IC for isolated A/D Converter												
HCPL-0870														

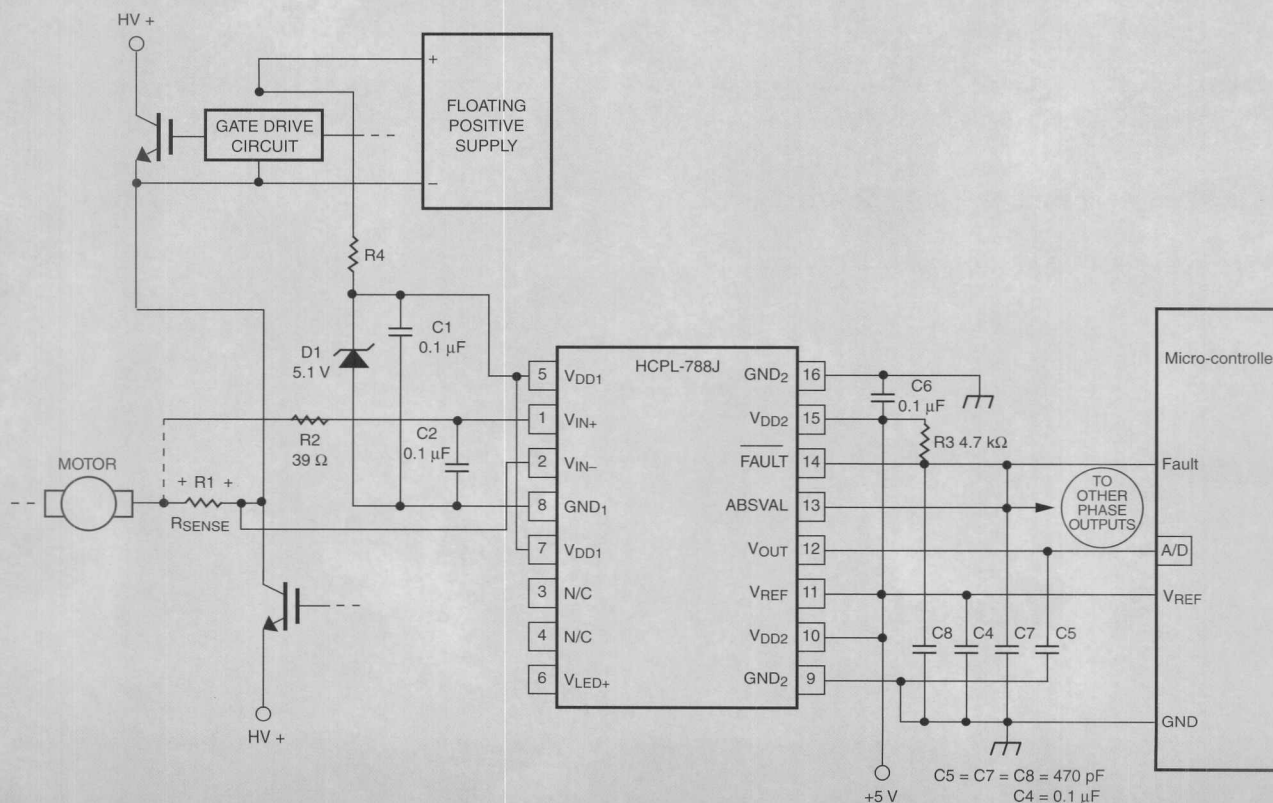
HCPL-788J																•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•			•</
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Red bold text – RECOMMENDED FOR NEW DESIGNS

NOTES: 7. 890 V peak VDE 0884 with option 060. 8. HCPL-7800A with 1% Gain Tolerance.

The HCPL-788J can be used for isolating the motor current sensing element from the control circuit while at the same time transmitting precision analog signals over-current fault signals. This circuit requires a high precision-sensing resistor for monitoring the motor current. The single-ended output allows it to directly interface with the A/D port of the micro-controller. Other benefits include an in-built fault detection high CMR and smaller size compared to Hall effect devices.

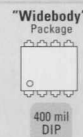
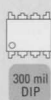
## Typical Motor Current Sensing with Over Current Detection Block Diagram





# Line Receiver

## Packages



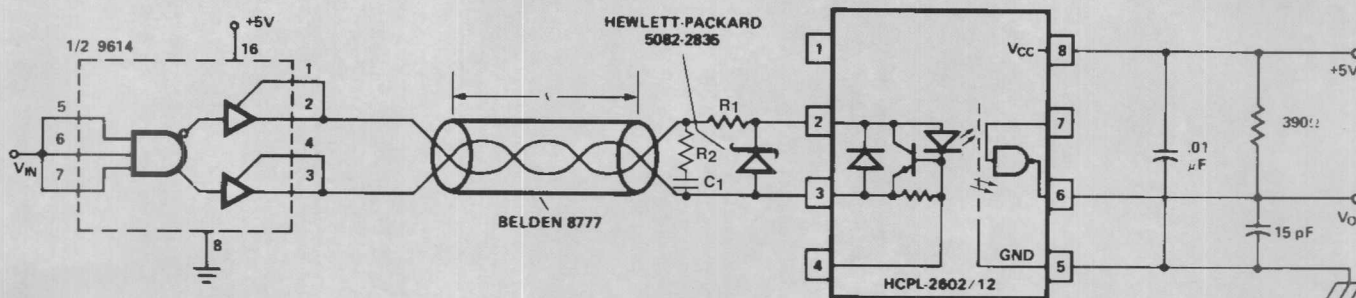
Device	Part No.	Package	Output Collector Current	Prop Delay	CMR-V/ $\mu$ s @ (Vcm)	
		300 mil DIP	mA (max)	ns (max)	1000 (150)	3500 (300)
	HCPL-2602	•	50	100	•	•
	HCPL-2612	•	50	100	•	•

- 40 ns max propagation delay skew (part to part)
- Line termination circuitry included
- 2500 Vac UL approval

The HCPL-2602/12 have input current regulators and integrated high gain photo detectors. The input regulator serves as a line terminator for line receiver applications. The higher LED threshold voltage provides improved immunity to differential noise and the rejection internally shielded detector provides better common-mode rejection with no sacrifice in speed.

The figure illustrates an unbalanced line receiver using the integrated voltage-clamp input optocoupler, HCPL-2602. TTL data is converted to a differential signal via the differential line driver, and transmitted over twisted-pair wire. The Schottky diode helps

## Typical Block Diagram

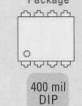


# 20 mA Current Loop Transmitter/Receiver

## Packages

300 mil  
DIPSMD  
Package

SO 8

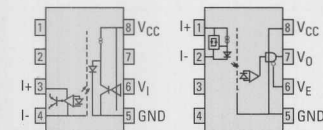
"Widebody"  
Package400 mil  
DIP

SO-5

SMD  
Package

SO 16

Device	Part No.	Package	Data Rate – kB @ (meters)		Prop Delay	CMR-V/ $\mu$ s @ (Vcm)	
		300 mil DIP	20 400	20 1400	$\mu$ s (max)	1000 (150)	1000 (50)
HCPL-4100	HCPL-4200	HCPL-4100	•	•	1.6	•	
		HCPL-4200	•	•	1.6		•



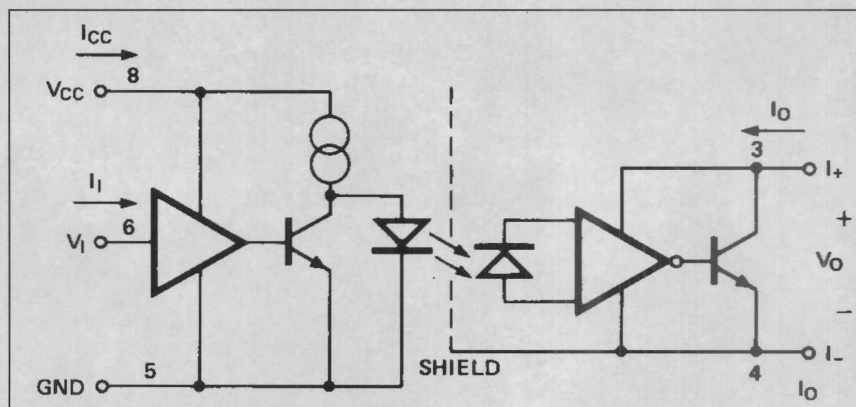
- CMOS compatible data input for HCPL-4100
- CMOS compatible data input for HCPL-4200
- 2500 Vac UL approval

Red bold text – RECOMMENDED FOR NEW DESIGNS

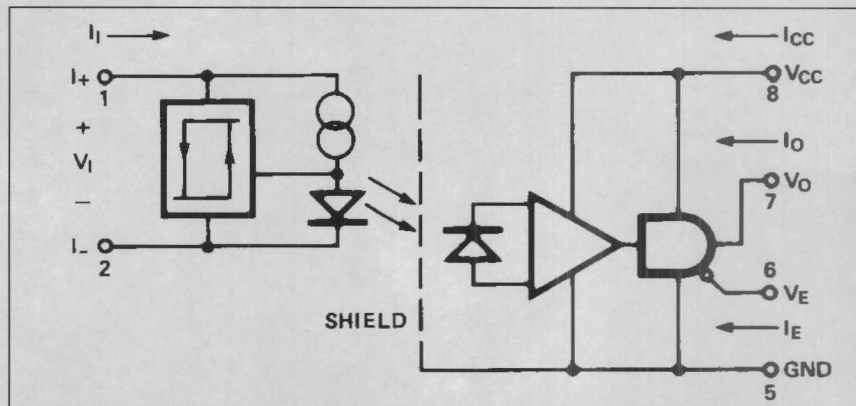
Data transmission between electronic equipment which are physically separated by distance of more than few feet can be achieved using HCPL-4100 (transmitter) and the HCPL-4200 (receiver) optocouplers. These devices include specialized circuits for 20 mA digital current loop applications. These optocouplers are designed to easily interface TTL and CMOS logic systems to current loop systems. 20 mA current loop systems conventionally signal a logic high state by transmitting 20 mA of loop current and signal a logic low state by allowing no more than few milli amperes of loop current. Optical coupling loop breaks ground loops and provide very high immunity to common mode interference. These devices are simple to use in a data transmission system for industrial applications and maintains data integrity.

## Typical Block Diagram

### HCPL-4100 TRANSMITTER



### HCPL-4200 RECEIVER



# AC/DC to Logic Interface

## Packages



300 mil DIP

### SMD Package



SO 8

### "Widebody" Package



400 mil DIP

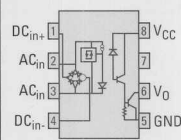


SO-5

### SMD Package



SO 16

Device	Part No.	Package	Input Threshold Current		Hysteresis	Prog Delay
		300 mil DIP	mA (min)	mA (max)	mA (typ)	μs (max)
	HCPL-3700	•	1.96	3.11	1.2	40
	HCPL-3760	•	0.87	1.56	0.6	40

- CMOS compatible output
- 600 V/μs CMR @  $V_{cm} = 150$  V
- 2500 Vac UL Approval

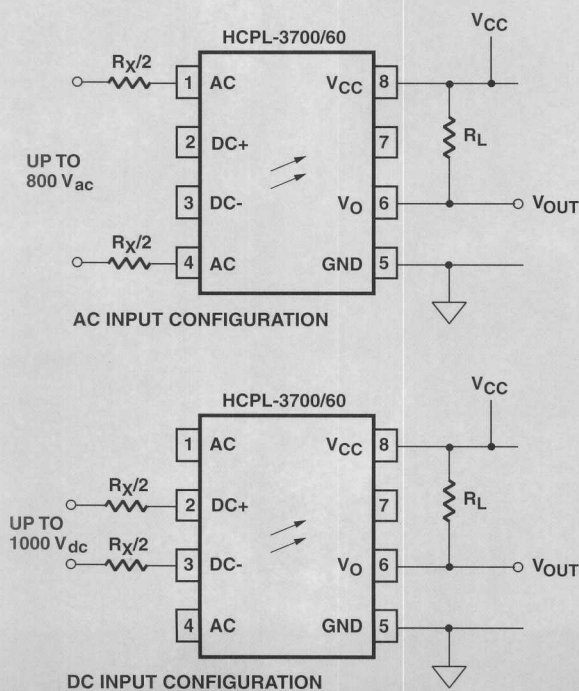
Red bold text – RECOMMENDED FOR NEW DESIGNS

In the implementation of an interface from an electrically noisy environment into logic systems, it is often desirable to establish some current or voltage switching point or input switching threshold which is resolved in the design of HCPL-3700 optocoupler. This device combines an ac or dc voltage and/or current detection function with a high sensing input buffer ICs which permit control of threshold levels over a wide range sensing industrial control system, ring detection in telephone system micro-processor interfacing.

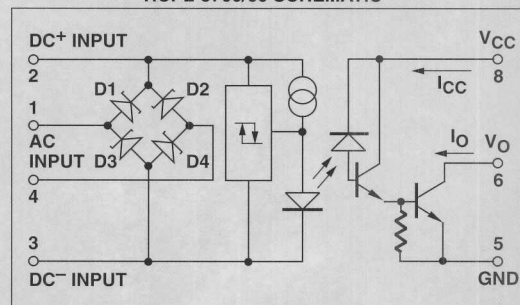
The HCPL-3700/60 Threshold-Sensing Optocoupler can be used for sensing the ac/dc power on/off condition. At the optocoupler input, only a pair of series resistors  $R_X/2$  are required to limit the current. The ac signal can be filtered with a capacitor at either the input or the output of the optocoupler. The value of  $R_X$  determines the threshold sensing voltage.

HCPL-3700/60's low threshold current reduces power dissipation and its in-built diode bridge and hysteresis circuit reduces the number of external components to be used.

## Typical Block Diagram



## HCPL-3700/60 SCHEMATIC





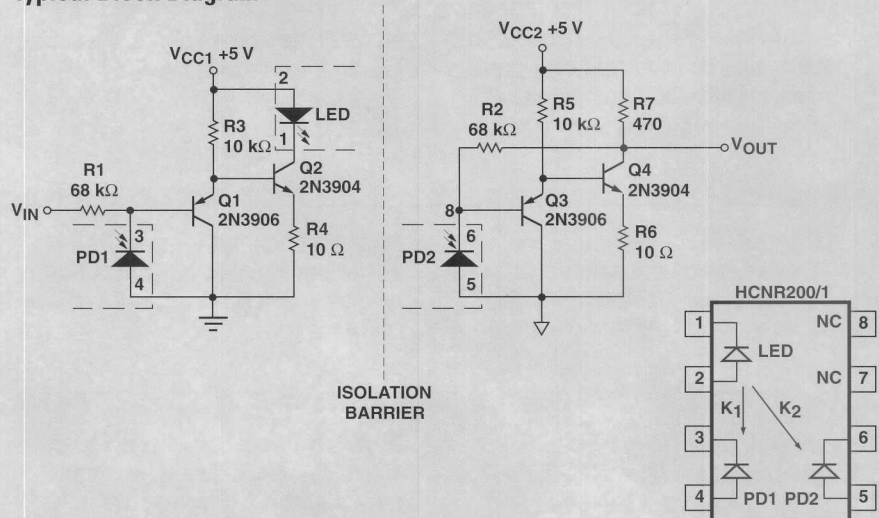


## Analog Isolation Applications with Linear Optocouplers

Agilent's HCNR200/1 and HCPL-4562 constitute basic optical coupling building blocks for high linearity isolation applications. The HCNR200/1 constitute a high performance LED and two closely matched photodiodes. The output photodiode produces a photocurrent that is linearly related to the light output of LED. These optocouplers are highly suitable for the use in the feedback path of switched mode power supplies and motor speed and position measurement. Very high linearity and excellent low transfer gain variation are the advantages of using HCNR200/1.

This is a high-speed, low-cost isolation amplifier for use in the feedback path of switch-mode power supplies or motor speed and position measurement. This circuit can be used in applications where high bandwidth, low-cost, and stable gain are required.

**Typical Block Diagram**

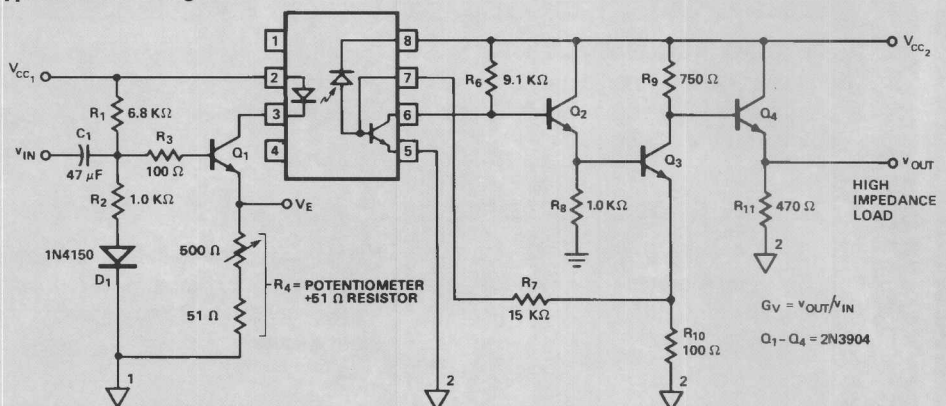


The HCPL-4562 and HCNW 4562 are recommended for a very high bandwidth (up to 15 Mhz) AC analog designs such as coupling audio or video signals.

This circuit, with the HCPL-4562 Wideband Analog/Video Optocoupler, is optimized for video signal coupling. The peaked response of the detector circuit helps extend the frequency range over which the gain is relatively constant. The number of gain stages, the overall circuit topology, and the dc bias point are all chosen to maximize the bandwidth.

HCPL-4562 provides simple and cost effective solution for coupling audio and video signals.

**Typical Block Diagram**





# Quick Guide to

## Direct Upgrades

UPGRADE PART	FEATURE	BENEFIT
<b>Improved Isolation /Insulation</b> Ability to protect surrounding circuitry against physical damages resulting from differential voltages.	HCNW family offers highest available working voltage ratings with regulatory approval per VDE 0884 of 1414V peak.	Meets international safety regulations and standards. Provide better isolation and overall safety performance.
<b>High CMR</b> Common-mode transient rejection or signal isolation of data through suppression of noise transients.	Agilent offers guaranteed CMR performance up to 15kv/ $\mu$ s (30 kv/ $\mu$ s typical) which is the highest available in the market.	Improves system performance, and reliability. More robust systems and better data integrity meet EMI and ESD requirements.
<b>Drive Current, <math>I_f</math></b> Low Drive Current, LED or light-emitting diode drive current.	Agilent offers the lowest $I_f$ (up to 40 $\mu$ A) devices in the market and boardest HCMOS compatibility.	Eliminates additional LED drive circuitry. Improves system efficiency and reduces power consumption and LED degradation.
<b>Propagation Delay, <math>T_p</math></b> It is a figure of merit to describe how quickly a logic signal can propagate through the system.	High Speed digital optocouplers to meet wide range of applications with $T_p$ as low as 40ns.	Increase switching efficiency and better speed performance.
<b>Surface Mount Device</b> SMD permits more component density than DIP.	Smaller package to deliver the same functionality as standard DIP. True surface mount technology and standard footprint.	Lower assembly cost, easier and faster handling as well as better solderability.

# Quick Guide to Direct Upgrades

## CMR

### Recommended Part

### Remark

6N135 6N136 HCPL-4502	HCPL-4503	Higher CMR
	HCPL-4504 HCPL-J454	Higher CMR + Higher Switching Speed
	<b>HCPL-4506</b> <b>HCPL-J456</b>	Higher CMR + Higher Switching Speed + Lower If
HCPL-0500	HCPL-0453	Higher CMR
HCPL-0501	HCPL-0454	Higher CMR + Higher Switching Speed
HCPL-4502	<b>HCPL-0466</b>	Higher CMR + Higher Switching Speed + Lower If
HCNW135	HCNW4503	Higher CMR
HCNW136	HCNW4504	Higher CMR + Higher Switching Speed
HCNW4502	<b>HCNW4506</b>	Higher CMR + Higher Switching Speed + Lower If
HCPL-2530	<b>HCPL-4534</b>	Higher CMR + Higher CTR
HCPL-0530	HCPL-053	
6N137	HCPL-2611	Higher CMR
HCPL-2601	<b>HCPL-261N</b>	Higher CMR + Lower If
HCPL-0600	HCPL-0611	Higher CMR
HCPL-0601	<b>HCPL-061N</b>	Higher CMR + Lower If
HCPL-2630	HCPL-4661	Higher CMR
HCPL-2631	<b>HCPL-263N</b>	Higher CMR + Lower If
HCPL-0630	HCPL-0661	Higher CMR
HCPL-0631	<b>HCPL-063N</b>	Higher CMR + Lower If
6N138	<b>HCPL-4701</b>	Higher CMR + Lower If
HCPL-0700	<b>HCPL-070A</b>	
HCPL-2730	<b>HCPL-4731</b>	
HCPL-0730	<b>HCPL-073A</b>	
HCPL-2200	<b>HCPL-2219</b>	Higher CMR
HCPL-2201	<b>HCPL-2211</b>	
HCPL-2202	<b>HCPL-2212</b>	
HCPL-0201	<b>HCPL-0211</b>	
HCNW2201	<b>HCNW2211</b>	
HCPL-2231	<b>HCPL-2232</b>	

## If

### Recommended Part

### Remark

6N135 6N136 HCPL-4502	<b>HCPL-4506</b> <b>HCPL-J456</b>	Lower If + Higher CMR + Higher Switching Speed
HCPL-0500 HCPL-0501 HCPL-4502	<b>HCPL-0466</b>	
HCNW135 HCNW136 HCNW4502	<b>HCNW4506</b>	
6N137 HCPL-2601	HCPL-261A <b>HCPL-261N</b>	Lower If Lower If + Higher CMR
HCPL-0600 HCPL-0601	HCPL-061A <b>HCPL-061N</b>	Lower If Lower If + Higher CMR
HCPL-2630 HCPL-2631	HCPL-263A <b>HCPL-263N</b>	Lower If Lower If + Higher CMR
HCPL-0630 HCPL-0631	HCPL-063A <b>HCPL-063N</b>	Lower If Lower If + Higher CMR
6N138 HCPL-0700 HCPL-2730 HCPL-0730	HCNW4503 HCNW4504 <b>HCNW4506</b> <b>HCPL-4534</b>	Lower If + Higher CMR

## SMD

### Recommended Part

6N135	HCPL-0500
6N136	HCPL-0501
6N137	HCPL-0600
6N138	HCPL-0700
6N139	HCPL-0701
HCPL-2201	HCPL-0201
<b>HCPL-2211</b>	<b>HCPL-0211</b>
HCPL-2530	HCPL-0530
HCPL-2531	HCPL-0531
HCPL-2601	HCPL-0601
HCPL-2611	HCPL-0611
HCPL-261A	HCPL-061A
<b>HCPL-261N</b>	<b>HCPL-061N</b>
HCPL-2631	HCPL-0631
HCPL-263A	HCPL-063A
<b>HCPL-263N</b>	<b>HCPL-063N</b>
HCPL-2730	HCPL-0730
HCPL-2731	HCPL-0731
HCPL-4502	HCPL-0452
HCPL-4503	HCPL-0453
HCPL-4504	HCPL-0454
<b>HCPL-4506</b>	<b>HCPL-0466</b>
<b>HCPL-4534</b>	<b>HCPL-0534</b>
HCPL-4661	HCPL-0661
<b>HCPL-4701</b>	<b>HCPL-070A</b>
<b>HCPL-4731</b>	<b>HCPL-073A</b>

**NOTE:** All SMD (S08) parts are prefix with "0".

## SAFETY REGULATORY

### Recommended Part

6N135	HCNW135
6N136	HCNW136
6N137	HCNW137
6N138	HCNW138
6N139	<b>HCNW139</b>
HCPL-2201	HCNW2201
<b>HCPL-2211</b>	<b>HCNW2211</b>
HCPL-2601	HCNW2601
HCPL-2611	<b>HCNW2611</b>
HCPL-4502	HCNW4502
HCPL-4503	HCNW4503
HCPL-4504	HCNW4504
<b>HCPL-4506</b>	<b>HCNW4506</b>
HCPL-4562	HCNW4562

**NOTE:** All HCNW have better safety regulatory specification.

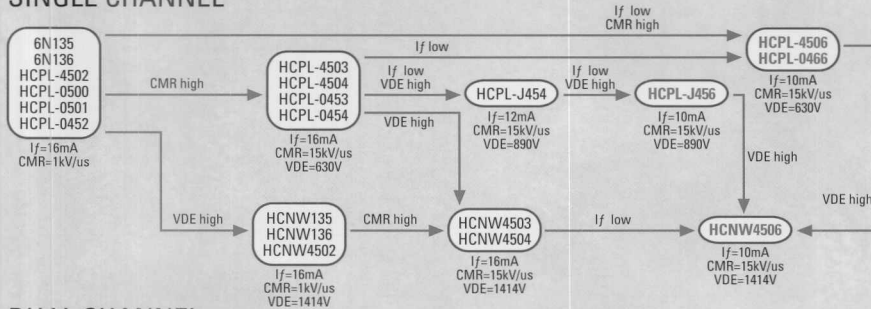
Red bold text – RECOMMENDED FOR NEW DESIGNS

# Improved Paths

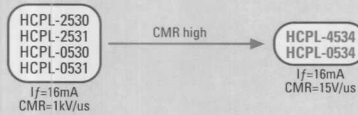
## Upgrade Charts

### 1MBd TRANSISTOR OUTPUT OPTOCOUPLER (6N135/6 TYPE)

#### SINGLE CHANNEL

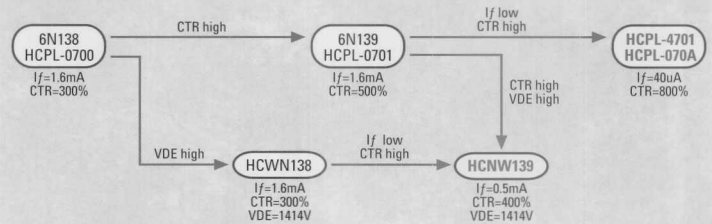


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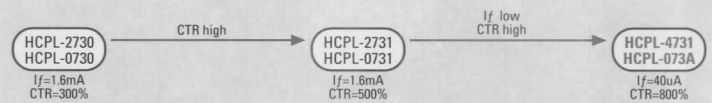


### 100KBd LOGIC GATE OPTOCOUPLER (6N138/9 TYPE)

#### SINGLE CHANNEL

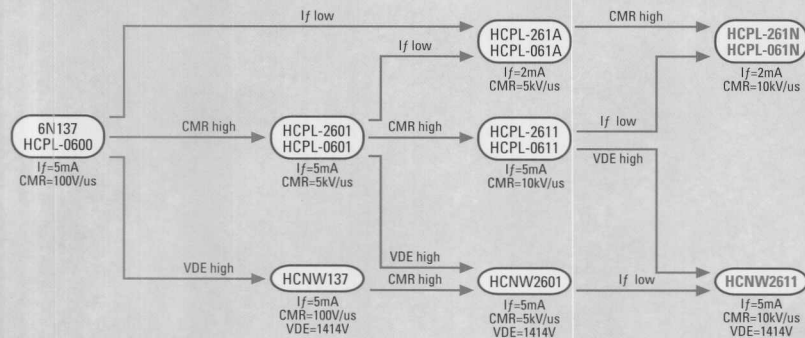


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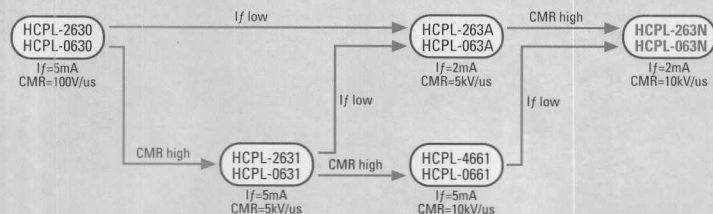


### 10MBd LOGIC GATE OPTOCOUPLER (6N137 TYPE)

#### SINGLE CHANNEL

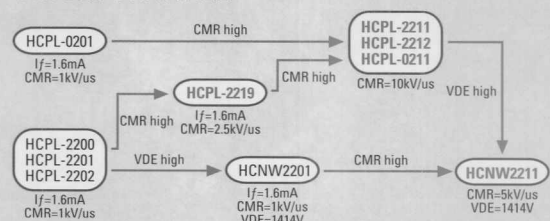


#### DUAL CHANNEL

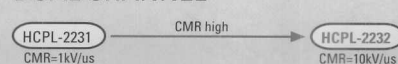


### 5MBd LOGIC GATE OPTOCOUPLER (HCPL-2200 TYPE)

#### SINGLE CHANNEL



#### DUAL CHANNEL



Red bold text – RECOMMENDED FOR NEW DESIGNS

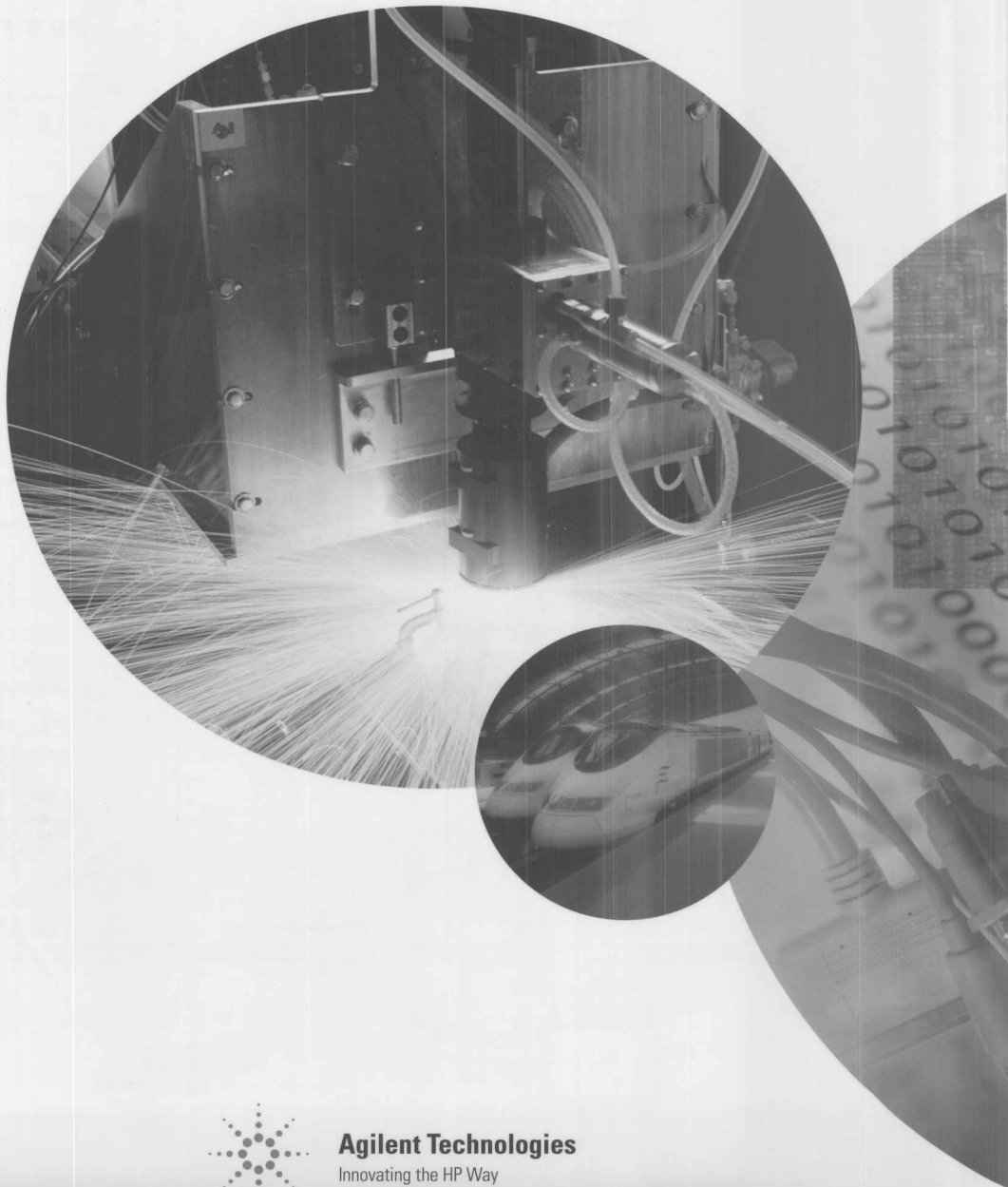




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